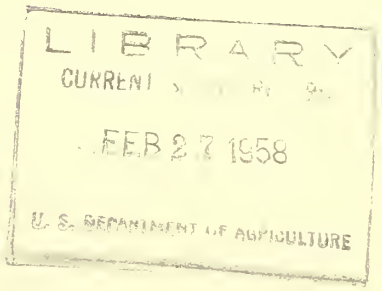
Report of the

FOURTEENTH SOUTHERN PASTURE AND FORAGE CROP IMPROVEMENT CONFERENCE

Kentucky Experiment Station

Lexington, Kentucky

June 11 - 13, 1957



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FOURTEENTH SOUTHERN PASTURE AND FORAGE CROP IMPROVEMENT CONFERENCE [1/]

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Tuesday, June 11, 1957

Tuesday Afternoon, June 11

Wednesday Morning, June 12

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1/ Reported by M. S. Offutt, Ark., W. A. Kendall, Ky., and W. B. Anthony, Ala.; and compiled by P. R. Henson, Permanent Secretary, U. S. Department of Agriculture, Agricultural Research Service, Beltsville, Md.

Wednesday Morning (cont.)

Wednesday Afternoon, June 12

Groups 1, 3 and 4 - W. E. Knight, Miss., Chairman
W. A. Kendall, Ky., Section Secretary

Wednesday Afternoon (cont.)

Thursday Morning, June 13

Groups 1 and 2 - R. W. Engel, Va., Chairman
W. B. Anthony, Ala., Section Secretary

Tuesday Morning, June 11, 1957

W. W. Huffine, Okla., Chairman

9:00 A.M The first general session of the fourteenth Southern Pasture and Forage Crop Improvement Conference convened with Dr. Wayne Huffine as chairman. Dr. Huffine introduced Dr. G. T. Webster, Head of the Agronomy Department at Lexington, Ky. Dr. Webster welcomed the group to Kentucky and introduced Dr. Frank J. Welch, Dean of the College of Agriculture, Director of the Agricultural Experiment Station, and Director of Extension. Dean Welch, in welcoming the members of the conference to Kentucky, called attention to the changing forage program which is resulting in finer herds in the region.

9:15 A.M. Introduction of Members and Visitors. The members were introduced by states. At this opening session the number from each state was as follows:

Alabama	6	North Carolina	7
Arkansas	1	Oklahoma	5
Florida	5	Puerto Rico	3
Georgia	7	South Carolina	6
Kentucky	14	Tennessee	2
Louisiana	2	Texas	4
Maryland(USDA)	5	Virginia	9
Mississippi	4		

Announcements with respect to tours and program meetings were made by Dr. Stroube of the Kentucky station. Dr. Huffine called attention to the fact that the term of Dr. Chamblee had expired and a new member of the Executive Committee was to be elected. A nominating committee composed of A. A. Hanson, H. W. Bennett and T. J. Smith was appointed to nominate the new member.

9:30 A.M. Report on the Seventh International Grassland Congress, E. N. Fergus, Ky.

Dr. Fergus reviewed the organization and objectives of the Congress. There were approximately 200 delegates to the Congress, representing 34 political subdivisions. The program was divided into 13 sections. The importance of discussion was stressed. Presentation of technical papers was limited to 15 minutes with 30 minutes allowed for discussion. Dr. Fergus felt that the discussions were very good.

10:00 A.M. Tour of nearby research areas. The group was divided into four sections, each being transported on tractor-drawn trailers to specific areas. At each stop members of the agronomy staff explained the work under way, discussed the results and answered questions.

Experiments observed and discussed included: (1) Grass-legume mixtures: orchardgrass-Ladino, tall fescue-alfalfa, and others for hay and silage; (2) Rate of seeding in mixtures; (3) Variety tests, bromegrasses, alfalfa for pasture, red clover varieties in bluegrass; (4) Red clover breeding, irradiation, origin and breeding of Kenland; (5) Rotations; (6) Disease resistance studies; (7) Tall fescue and orchardgrass breeding nurseries and plots; (8) Pasture management studies involving grazing

studies with tall fescue, bluegrass and orchardgrass; and (9) Fescue toxicity - "fescue foot". There was considerable discussion at each stop, indicating a most profitable tour.

Tuesday Afternoon, June 11

Field Tour - At 1:30 the conferees left by buses, stopping first at the Woodford Farm. First- and second-year seedings of the red clover varieties were observed. Pastures of bromegrass and Kentucky bluegrass. each with white clover, and Kentucky bluegrass-birdsfoot trefoil were being grazed by beef cattle. The recently acquired new farms a few miles from Lexington were also observed. The new farms, totaling 1100 acres, are expected to replace present farms now im use near the University campus.

Wednesday Morning, June 12

8:00 A.M. Groups 2, 3, and 4. R. D. Staten, Texas, Chairman
M. S. Offutt, Arkansas, Section Secretary.

Research in Grasslands of New Zealand - G. W. Burton, Coastal Plain Expt. Station, Tifton, Ga.

It would be impossible to cover the Grasslands Research of New Zealand in the time and space allotted here. I shall only undertake to give a brief picture of its organization, its objectives, its personnel and its achievements as I saw them in the very limited time that I had for such study.

The plant side of this research is well organized as the Grasslands Division in the Department of Scientific and Industrial Research under the directorship of Dr. P. D. Sears. The headquarters are at Palmerston North, where 22 professional men and 45 technical assistants have good offices, laboratory, and greenhouse facilities but only 26 acres of land upon which to work. The Division has two branch stations on the South Island and two on the North. The research, which includes a good proportion of fundamental investigations, covers plant breeding and genetics, pedigree seed production and certification, pasture ecology, and plant physiology.

The plant breeders are concerned generally with the development of strains capable of high production of palatable, nutritious herbage and uniform spread of annual production. All species with which they are working are normally cross-pollinated and all released strains and those on the make are synthetics. They are based on a number of unrelated plants found to be elite on the basis of progeny tests (usually from polycrosses). Evaluation of thousands of these plants is almost entirely by visual rating. Dr. Glenday, their statistician, reported that their analyses showed a visual rating of 6 plants to be about as good as a

yield on 5. Corkill, who heads this program, indicated that self-sterile clones with high combining ability and low inbreeding depression are sought for the synthetics. The latter, he indicated, would be measured by studying selfed progenies if selfed seed could be produced. The new strain is produced by interplanting the superior clones in a special greenhouse to provide isolation. Breeding work designed to improve each strain still further is continued after its release. As "nucleus stock" is continually produced by the Grasslands Division, improved strains fed into certification gradually replace earlier certified strains. Syn. 2 becomes "nucleus stock", which is released to the Department of Agriculture, which takes the seed through Government Stock (Syn. 3), Pedigree Stock (Syn. 4), Mother seed (Syn. 5), and Permanent Pasture or Standard seed (Syn. 6). Only the last two classes reach the farm, and seed from permanent pasture cannot be re-certified. Improved strains of perennial ryegrass, Italian ryegrass, orchardgrass, timothy, white clover, and red clover have been released. Work is also underway with Lotus species, Zigzag, and strawberry clover. Genetic studies include quantitative-inheritance investigations, cytogenetic studies of Lolium-festuca hybrids, and inheritance of plant markers, biochemical variations, nutritional requirements of plants, and plant-hormone activity.

The plant physiologists are using controlled-environment chambers and are recording the microclimate at 25 stations in the country in an effort to better understand the behavior of pasture plants in the field.

The pasture ecologists are studying the relation between soil fertility and pasture productivity, the effects of treading on pasture, grazing practices, weed control, ensilage, natural regeneration of clovers, oversowing and sod seeding, roots of pasture plants, the rate of pasture growth, and many other related problems. Sears' study, which involved returning the ground-dried clippings or the major plant nutrients removed in clippings in the form of fertilizer to certain plots in comparison with those not so treated, was interesting. Since stock are on the pastures almost constantly, it was argued that nutrients, except those going into animal products, should be returned to clipped plots to give a true p icture of their production.

An excellent plant-chemistry laboratory with 7 chemists and a physiologist is located at the Grasslands Division. These men are studying bloat, the components of such major plant constituents as the proteins, fats, and carbohydrates, nitrogen fixation by rhizobial populations, etc.

The most active and best known animal research station is the Department of Agriculture Animal Research Station at Ruakura. The Superintendent of this 870-acre station, located in one of the most intensive grassland and livestock areas in the world, is C. P. McMeekan. On the station there are 2,000 breeding ewes, 500 dry sheep, 200 beef cattle, 650 dairy cattle, and 40 breeding sows all used for research. The staff consists of some 30 professional people, 50 technicians, and 100 laborers. The station is organized into a series of small, independent farm units, each of which is under the control of a specialist and is devoted to a study of one or more related problems. The station is concerned primarily with

the problems of pasture utilization rather than production. Much of their research with dairy cattle involves the use of identical twins, over 400 sets having been studied to date. McMeekan stated that identical twins were 40 times more efficient than random cattle as research animals. A unique study, involving the splitting of identical twins from 400-pound-butterfat and 200-pound-butterfat herds and sending one of each set into a high and low herd, has shown most of the difference in high and low herds is due to environmental causes. Twins split between Fiji (tropical) and New Zealand (temperate) are receiving the same feed and are being used to study the effect of climate on development, milk flow, etc. A recent report indicates the twins in the temperate climate are producing, on the average, twice as much milk as those in the tropics--both receiving identical feed.

McMeekan said, "The cost of foraging and grazing is high, requiring approximately a 50% addition to the standard maintenance cost as measured on European stall-fed cattle." Their nutrition work with dairy calves demonstrated that good calves could be produced on good pasture alone, weaning them when only 8 weeks old. Well-reared heifers produced 20 pounds more butterfat than 2-year-olds, 10 pounds more than 3-year-olds, and no more after that than poorly reared heifers. The latter were 80 pounds lighter when mature and, at that time, were more efficient than the well-reared animals. These were but a few of the interesting results reported from the excellent fundamental research on forage utilization by cattle and sheep. It seemed unfortunate that this research was located 100 miles from the Grasslands Division center and that their activities could not be more closely coordinated.

In New Zealand, the Extension Division operates a number of research stations. We visited two of these stations, the Rukuhia Soil Research Station and the Marton Experimental Area. The former is concerned with research on a number of the soils in the region and also maintains a soil-testing service. A list of their activities would parallel a list of the activities of any good soils-research department in the United States. The Marton Experimental Area is devoted primarily to pasture trials, the production being measured in terms of dry matter from mown herbage supplemented by botanical analyses and herbage dissection. Techniques consist of various cage or alternate mowing and grazing techniques or mowing and returning the dried clippings where no grazing was practiced. There was no doubt in the minds of the workers at this station but that animal production would be closely correlated with the dry-matter production from their treatments. Research here included studies on spelling (rotation grazing), fertilization, weed control, pasture establishment, species and variety evaluation, and nutrition.

To assist in what must be an excellent extension program (judging from the good pastures that we saw wherever we went), the New Zealand Extension Division also maintains a number of Demonstration Farms. These farms must be self-supporting units. Members of the Extension Service plan the feed program and animal management on these farms, initiating new practices as soon as the research groups recommend them.

It has been said that the agricultural development of a section is a good index of the quality of its research, teaching, and extension work. If this be true and if the part of New Zealand that I saw was representative, then the grassland research, extension, and teaching in New Zealand must be rated excellent.

8:30 A.M. Breeding Blue Lupine for Disease Resistance - Ian Forbes, Jr., and H. D. Wells, Coastal Plain Expt. Station, Tifton, Ga.

Blue lupines (Lupinus angustifolius L.) are highly productive, annual legumes which are grown in Georgia, Florida, and Alabama as cover crops and temporary, late-winter pastures. Blue lupines are self-pollinated and good seed yields are obtained by the farmer in this area.

The forage variety in use, Borre sweet blue, is susceptible to injury by anthracnose, caused by Glomerella cingulata (Stonem.) Spauld. and V. Schrenck, to grey leafspot, caused by Stemphylium solani Weber, and brown spot caused by Pleicohaeta setosa (Kirchn.) Hughes. These three pathogens may attack any aboveground part of the plant in the seedling or adult stage and have resulted in severe losses of forage and seed. Since G. cingulata also attacks peach, the use of blue lupine in peach-growing areas has declined. Stemphylium solani regularly defoliates blue lupines at the present southern limits of its adaptation in north Florida to such an extent that economical seed production is not practicable. Brown spot often results in the complete loss of the crop where it is grown year after year without rotation.

A large scale greenhouse artificial inoculation and screening technique has been developed for use in evaluating blue lupine plants for their reaction to these diseases. Replicated plantings are made of each seed lot to be tested in steam-sterilized soil in 6-inch pots in the greenhouse in the fall. When two to three weeks old, the plants are sprayed with an aqueous suspension of conidia and mycelia of the fungus and placed in a fog chamber for 48 hours. After growing in the greenhouse for another two weeks, the plants are rated for injury on a 0 (no injury) to 5 (plant killed) scale. The highly susceptible Borre sweet blue lupine is used as a control and has always been killed by this treatment. The disease-susceptible plants are discarded and the healthy ones are reinoculated and rated a second time to insure against susceptible "escapees" dislocating the breeding program.

J. L. Weimer found resistance to anthracnose in some introduced Portuguese seed lots, but those plants were unproductive, late-maturing, small-seeded, hard-seeded, and contained the poisonous, bitter alkaloid, lupanin. Hybrids have been obtained between the resistant plants and plants having desirable agronomic characteristics. Improved anthracnose-resistant lines are now in the F_6 generation. These lines have been inoculated and screened each generation, beginning with the F_3.

Using the same inoculation and screening technique, several domestic and introduced lupine seed lots were found which are resistant to the grey leafspot disease. Hybrid seeds were obtained in 1957 which should give rise to plants having the following desirable characteristics: resistance to anthracnose and grey leafspot, absence of alkaloid production, good forage production, early maturity, normal seed size, soft seeds, and genetic varietal markings (white flowers, white seeds, and

no purple pigments in vegetative parts).

To date none of the blue lupine seed lots in the breeding program have been found to be resistant to brown spot.

8:55 A.M. Vetch Improvement - R. P. Bates, Samuel Roberts Noble Foundation, Ardmore, Okla.

Vetch appears to have a place on many Oklahoma farms for grazing, seed production, and soil improvement. It is used widely in permanent pastures such as Bermudagrass and K. R. bluestem. At Ardmore, during winter and spring months, vetch usually produces about three-fourths as much beef as Midland Bermudagrass produces during the summer months. Vetch is used in temporary pastures with rye and oats. It adds income to a small grain pasture by producing a seed crop. Soil fertility is often improved in permanent pastures, temporary pastures and crop land by the growth of this species.

Some objectives of a vetch improvement program in Oklahoma should be early forage production, winter hardiness, bruchid resistance, seed production, disease resistance, and identifying characteristics.

Vetch samples collected in southern Oklahoma indicate that the vetch bruchid is a definite threat to vetch seed production in this area. Individual plants of Vicia villosa have ranged from 10 to over 80 percent seed damage by this insect. Progeny rows have varied from about 15 to 60 percent damaged seed. Vicia villosa and V. dasycarpa strains grown at two locations showed similar bruchid damage at both locations. With 48 strains a correlation coefficient of .5304** was obtained between the two locations in 1956-57.

Several vetch species are resistant to the vetch bruchid. Species grown in 1955-56 that were not damaged by this insect are: V. ervilia, V. atropurpurea, V. cornigera, V. onobrychioides, V. pannonica, V. sativa and V. sativa var. leucosperma.

Crossing attempts have been tried in the greenhouse in an effort to combine early forage production, winter hardiness, and bruchid resistance into a strain with an identifying characteristic. Most cross pollinations thus far have been among different vetch species. Over 20 vetch species have been included in hybridization attempts. Most of these species are reported as having either 12 or 14 (2n) chromosomes. Variation exists among species in flower formation and pollination, and most of the species self-pollinate readily in the greenhouse. Strains of Vicia villosa and V. dasycarpa with which work has been done produce very few, if any, seed without tripping. Cross-pollinations have been made with and without emasculation. In 1954 plants were obtained from crosses by Dr. R. A. Chessmore that appeared to be hybrids; however, most of them died and the others did not set seed.

Several vetch strains have been selected that appear to produce more early growth than either commercial hairy or Madison vetch. These selections also appear to be winter hardy enough for southern Oklahoma. In 1956-57 six selections produced from 10 to 20 percent more forage by April 20 than commercial hairy and Madison vetches.

9:15 A.M. Tannoids in Lespedeza - R. E. Burns, Ga. Agric. Expt. Station, Experiment, Ga.

The progress of the author's work on tannoids as they are related to astringency in lespedeza, was covered in this paper. The Folin-Denis method of tannin analysis was used as a base from which to proceed. A low tannin variety of sericea, F.C. 23-864, was used for comparison with the other varieties. Paper chromatography was used to isolate the astringent fractions of sericea extract. The major astringent fraction was found to contain leuco-anthocyanins which, on hydrolysis, yield delphinidin and cyanidin. The delphinidin leuco-anthocyanin was by far the most abundant.

While there was some difference in tannoids present early, during most of the season the same tannoids were present in all varieties of sericea in about the same proportions, varying in the total amount.

A screening test which is being developed, using Vanillin and Hydrochloric acid, was described.

9:38 A.M. Can we Break the Apomictic Barrier? - J. R. Harlan, M. H. Brooks and R. P. Celarier, Okla. Agric. Expt. Station, Stillwater, Okla.

Apomixis is a remarkably successful evolutionary mechanism in nature. It is a characteristic mode of reproduction of a large number of the most successful opportunistic families and genera. In the grass family it is especially well developed in the Andropogoneae and Paniceae, where it may prove to be the dominant mode of reproduction. These are tribes of most interest to the South, and if we should some day learn to manipulate apomixis and actually make use of it as a breeding tool, many important and potentially useful groups will be made available to us. There is a great challenge and a great opportunity in learning to understand and use the mechanism and the stakes are high.

Some possibilities for the use of apomixis as a plant breeding tool include:

1. The immediate fixation of desirable types in a population
2. The fixation of F_1 plants with hybrid vigor
3. The production of wider crosses than is possible in sexual material
4. Genome building is greatly facilitated when apomixis is present
5. Isolation problems in increase are minimized
6. Genetic shift with advance in generation is eliminated

Our work with the Old World Bluestems has thrown some light on the problem. Generally, the group follows the classic pattern in which the diploids are sexual, the tetraploids are mostly but not entirely asexual, and the pentaploids and hexaploids are obligate apomicts or nearly so. One facultative tetraploid referred to, Bothriochloa venusta, has been crossed with a B. intermedia hexaploid from Australia, a B. ischaemum pentaploid from China, a B. ischaemum hexaploid from Turkey and a Dichanthium annulatum tetraploid from India. The plant used as a female

in each case is a waif picked up from British Guiana where it must have been introduced. An analysis of the hybrids showed that both n and 2n female gametophytes were functional.

The embryology of the mechanism is being studied. In general, pseudogamous apospory is found. Sexual sacs are readily distinguished from asexual sacs by the paired polar nuclei. The asexual sacs have single polar nuclei. Antipodal cells appear to be found only in the sexual sacs. Multiple sacs are common and as many as seven sacs have been seen in a single ovule. The sexual sac is frequently pushed aside by more readily developing asexual embryos. There seems to be a preference by the pollen for asexual sacs. The cause of this is not yet known. There is some hope that the percent of sexuality can be altered by the environment in facutative apomicts.

10:25 A.M. Breeding Objectives in Forage Radiation Breeding Programs -
T. J. Smith, Va. AGric. Expt. Station, Blacksburg, Va.

The following information was obtained from different research workers in the southern region who are known to be using radiation in their forage breeding research. There may be additional investigations that are not included.

This information is not intended to be complete or all inclusive, but only to give a general idea of the use that is being made of radiation in forage breeding.

It should be emphasized that most of these programs include considerable effort on fundamental studies - even though such is not stated following each crop.

A. Dallis grass - Georgia, Louisiana and Texas
   1. Vigor
   2. Mutation rate
   3. Incidence of apomixis
   4. Resistance to:
      a. ergot b. shattering c. leafspot diseases
   5. Increased seed production
   6. Superior biotypes

   Results - Four-fold increase in mutation rate in Georgia. No other results. Major emphasis will be on fundamental aspects.

B. Perennial lespedeza - Alabama, Mississippi and Tennessee
   1. Seedling vigor
   2. Leafiness
   3. Low tannin
   4. Disease resistance
   5. Increased palatability and nutritive value might include several factors including fine stems, low lignin, low cellulose, high digestibility of dry matter and protein.

   Results - Fine stem and leafy plant at Alabama.

C. Annual lespedeza - Tennessee(striata and stipulacea), Arkansas(stipulacea).
   1. Vigor
   2. Forage and seed yield
   3. Drought resistance
   4. Disease resistance
   5. Maturity differences
   6. Seed, flower or vegetative marker
   7. More leafy

   Results - None to date.

D. Alyce Clover - Mississippi
   1. Disease resistance

   Results - None to date.

E. Crimson Clover - Mississippi and Tennessee
   1. Resistance to diseases (Sclerotinia trifoliorum and others)
   2. Erectness
   3. Seed yield
   4. Retention of seed
   5. "Hardness" of seed

   Results - Nothing positive on above characters; several pigment changes obtained - flowers, leaves and stems.

F. Red Clover - Kentucky
   1. Increased longevity
   2. Fundamental studies

   Results - None to date.

G. Lupines - Florida (blue and yellow), Georgia (blue).
   1. Genetic markers
   2. Resistance to: a. Seed shattering b. diseases
      c. freezing injury
   3. Increased forage production
   4. Broader leaves
   5. More rapid and early growth for earlier winter grazing
   6. Alkaloid free (sweet) characteristics in blue lupine
   7. Virus resistance in the yellow lupine

   Results - Mutants have been obtained for following:
      1. Sweet characteristics in blue lupine
      2. Variations in seed coat colors
      3. Broader leaves
      4. Some seed shattering resistance
      5. Very rapid, early and taller plant than previously known in lupines.

H. Vetch - Tennessee
   1. Genetic markers for crossing studies
   2. Seed retention
   3. Combine erectness with winterhardiness

   Results - Nothing worthwhile to date.

I. Alfalfa - Arkansas and Virginia
   1. Persistence - several factors concerned
   2. More vigor, yield and quicker recovery of non-hardy types
   3. Disease resistance - leafspots and blackstem
   4. Resistance to leaf yellowing under stress conditions
   5. Increased vigor and rapidity of growth following cutting

   Results - None to date.

J. Rye - Florida and Georgia
   1. Compare recurrent selection on grain yield - with and without irradiation
   2. Better forage qualities, such as:
      a. Tillering capacity
      b. Early vigor
      c. Leafiness
      d. Shorter, stronger straw - maintain forage production
   3. Increased seed set and superior grain production by:
      a. Better pollen production
      b. Larger spikes
      c. Possibly three or more florets per spikelet as in wheat

   Results - Dwarf types with good tillering capacity are among best looking lines. Some chlorophyll deficient lines have appeared.

K. Oats - Florida
   1. Stem and crown rust resistance
   2. Mutants without awns and basal hairs in Floriland oats
   3. Compare recurrent selection on grain yield - with and without irradiation
   4. Other fundamental genetic studies

   Results - Objectives 1 and 2 already realized. Crown rust mutants are not stable at high temperatures.

L. Johnson grass - Texas

   Objectives not known

M. Sorghum hybrid (Sg-12, sudensis x vulgare) - Tennessee
   1. Disease resistance
   2. Increased tillering
   3. Increased leafiness

   Results - None to date.

N. Crotalaria spectabilis - Florida
   1. Alkaloid inhibiting mutation

   Results - None to date.

10:55 A. M. Natural Variation in Alfalfa and its Implication in Breeding - C. H. Hanson, Agric. Expt. Station, Raleigh, N. Car.

The breeder has at his disposal effective tools for increasing the variation in his populations. The purpose of this talk is not to minimize the importance of mutogenic agents in alfalfa breeding, but rather to consider certain genetic variations which occur in natural populations, and ways of utilizing them in breeding programs.

Slides were shown illustrating some of the variability in alfalfa as observed under North Carolina conditions. The illustrations were confined to those of economic importance to breeding and included the following: growth habit - including root, crown and stem; winterhardiness; disease, and insect resistance.

Considering the country as a whole. significant strides have been made in breeding alfalfa. The tremendous reservoir of variability in alfalfa, however, indicates the vast opportunities yet ahead. The present needs in alfalfa breeding do not appear to stress the importance of creating additional genetic variability, but rather the realignment of present genes found in alfalfa into new and improved genetic complexes.

In certain cases where a single breeding objective is involved (stem-nematode resistance and creeping rooted habit), concentration on one trait appears to be in order. In other cases where multiple objectives are sought, such as resistance to several foliar diseases, a recurring scheme of selection to increase the frequency of favorable genes appears preliminary to simultaneous selection for more than one trait.

Discussion:

Ruelke(Fla.): Are prostrate types of alfalfa more susceptible to diseases?

Hanson(N. Car.): No, not necessarily. No evidence to this effect has been indicated to date.

Ruelke: Where can seed of the creeping types be obtained?

Hanson: Rambler has been released by Heinrichs in Canada. Also, it is quite likely that Dr. Graumann of the USDA at Beltsville, Md., can furnish you with small amounts of seed for testing purposes.

11:27 A.M. Factors Influencing Ergot Infection in Dallisgrass - E. C. Holt, Agric. Expt. Station, College Station, Tex.

The ergot organism, Claviceps paspali Stevens & Hall, invades directly into the ovary of dallisgrass, Paspalum dilatatum Poir., and inoculation occurs only when the floret is in anthesis. The other flower parts do not serve as "ports-of-entry" nor are they later destroyed by the ergot fungus. However, they may be eventually destroyed by associated fungi. The view that fertilized florets are resistant to ergot is

supported by the fact that growth regulators (indole acetic acid and 2,4-dichlorophenoxy acetic acid) effectively reduced ergot incidence. It is likely that the indole acetic acid increase which normally follows fertilization, triggers the resistance mechanism in the fertilized ovaries.

Under the environmental conditions at College Station, Texas, in 1954, there was no evidence of any relationship between ergot incidence and weather. Ergot incidence was relatively constant throughout the summer. This may be explained by the fact that the changes in temperature were not great, and that the relative humidity was nearly constant during anthesis. This should not be interpreted to mean ergot incidence under great environmental fluctuations would be expected to be constant, because greenhouse tests with controlled humidity showed higher humidity to favor ergot.

Two factors conditioning the response of ergot to environmental changes:

1. The effect of weather is most critical during anthesis when the fungus and its substrate (the ovary) are exposed to the prevailing atmospheric conditions and not protected by the microenvironment created by their enclosure within the floral bracts.

2. Weather may have an indirect effect in that it influences seed-set(fertilization) which causes fertilized florets to become resistant to ergot. This effect may be negligible if both seed-set and ergot incidence are low. It would, then, be possible for the same weather conditions to favor both seed-set and ergot, although fertilization reduces the incidence of ergot in those florets which are fertilized. However, the effect of fertilization on ergot incidence would be increasingly evident as the empty glume fraction of the seed diminished.

Discussion:

Harlan (Okla.): Would it be feasible to clean up soil by spraying?

Holt(Tex.): We will spray the flowers instead.

James (Ga.): Horticulturists use Terrachlor to control fungi in many cases.

Burton (Ga.): Spraying with high concentrations of indole acetic acid and 2,4-D controlled ergot but reduced seed set in Georgia.

Owen(La.): Only limited control can be expected from ground spraying in local areas.

Henson (Ky.): Control of early infection appears to be the most important.

Earhart (S. C.): How long were plants held in the moist chamber?

Holt: Over night.

1:30 P.M. Groups 1, 3, and 4. W. E. Knight, Mississippi, Chairman
W. A. Kendall, Kentucky, Section Secretary

Invitational Paper: Production and Management of Grasslands in New Zealand, R. E. Blaser, Blacksburg, Va.

Dr. Blaser presented his impressions of the pasture management programs of New Zealand and Australia with respect to pasture mixtures and their methods of evaluation.

2:00 P.M. The Effect of Temperature and Moisture on the Yield, Flower Production and Persistency of White Clover, J.P. Craigmiles and L. V. Crowder, Experiment, Ga.

California Ladino and La. Syn 1 white clover were studied alone and in different grass sods both under irrigation and without additional water. Determinations were made on temperature, soil moisture, flowering, forage production, stolons per linear foot, percent clover to grass and other factors.

Four years' results (1953-56) show forage production to be dependent on soil moisture. Also, as the soil temperature increased, forage production decreased. There was a negative correlation between profuseness of flowering and forage production in both irrigated and not irrigated. There was also a negative correlation between temperature and persistency in both irrigated and unirrigated plots the first year.

Stolon rots severely damaged both types of white clover but were more severe on intermediate types, especially after profuse flowering. Following the stolon rot damage, dry soil conditions and high summer temperature caused the stolons to desiccate and die. If ample soil moisture is available the stolon rot continues growth and damages the clone, although the clone is able to persist and produce forage several weeks later than when moisture is not available.

2:15 P.M. Some Factors Affecting the Quality of Dallisgrass Seed Produced Under Field Conditions in Louisiana, C. R. Owen Baton Rouge, La.

Among the factors which affect the quality of Dallisgrass seed produced in Louisiana, the problem with weed control is probably the most important. Weeds present problems in the establishment and maintenance of stands of the grass as well as produce seed which may be difficult to separate, thereby reducing the value of Dallisgrass seed for planting. Among the weeds commonly found are barnyard grass, Echinochloa crusgalli; goosegrass, Eleusine indica; crabgrass, Digitaria spp.; Johnsongrass, Sorghum halepense; dock, Rumex spp., and others. Weeds may be controlled to some extent by proper management. Fields which are badly infested with weeds should be avoided.

Ergot, Claviceps paspali, is almost always present in Dallisgrass seed produced in Louisiana. The extent of damage from this fungus varies with the seasons and years. It is less severe in seed produced during the spring. Infection is ordinarily highest in seed formed during July and August and decreases with the approach of autumn; however, there have been exceptions to this tendency during some years.

Better quality seed should result from seed harvested in late spring. Thus it is suggested that grass and fields be fertilized with 30 to 45 pounds of nitrogen per acre in early spring in order that seed production may be stimulated at the proper period. From two to three harvests of seed per growing season may be made with favorable weather. Nitrogen fertilizer should be applied after each seed harvest in order to stimulate seed production of the ensuing period.

The cleaning process and storage of seed affect the quality equally as much as any practice during the growing season. Most Dallisgrass seed have more inert material after harvest than is allowed and this must be removed before the seed is sacked for the market.

Discussion:

Question: Have you attempted to obtain resistance to ergot by crossing?
Answer: No. Dr. Burton may have made such crosses so I will refer the question to him.
Dr. Burton: Several crosses were made but they were found to be sterile.

2:30 P.M. The Effect of Thickness of Stand on Yield Distribution and Seed Production of Dallisgrass, H. W. Bennett, State College, Miss.

Dallisgrass was transplanted at spacings of 1-2-4-6-9-18-36 inches per square yard plot. Eight replications per spacing were used. Forage yields were higher for the closer spacings with the green weight yield of the 1-inch spacing being 2½ times that of any other spacing. Per plant yields increased as spacing increased. Crude protein content of forage was higher for the closer spacings. Per acre yields of seed were not significantly different for different spacings. Per plant seed yields significantly increased as spacing increased. One plant per square yard produced approximately the same seed yield as 1369 plants per square yard.

Discussion:

Question: What size were the plots?
Answer: Eight by three feet.
Q.: Was seed harvested during a three-year period?
A.: No. Three harvests were made during one year.
Q.: Are the pounds per acre figures calculated on a dry weight basis?
A.: No. They were calculated on a green weight basis.

2:45 P.M. The Influence of Nitrogen Fertilization and Rainfall on the Production of Pensacola Bahiagrass, E. R. Beaty, T. Hayden Rogers and John D. Powell, Athens, Ga.

Two years' yield data obtained on Pensacola bahiagrass at the Nursery Branch Experiment Station, Americus, Ga., showed the following yield at the given nitrogen application rates.

Pounds of N[1]	0	25	50	100	240
Pounds of over-dry bahia forage	3086	4007	5046	7109	8949

Average percent of total production by months was:

May	June	July	August	September
5.14	32.52	37.83	17.55	6.86

Nitrogen application had little influence on the seasonal distribution of forage production.

Rainfall did not stimulate the grass to earlier production, however, rain does stimulate or lack of rain depresses production later in the season, as indicated by the following data:

	July		August	
	1955	1956	1955	1956
Rainfall (inches)	4.72	6.79	2.70	0.55
Bahia produced[2]	18.70	56.96	27.24	7.86

[1] Applied in 3 equal applications in April, June and August. Lime, P_2O_5, and K_2O uniformly applied.

[2] Percent of total for season.

Question: Were the white clover yields taken at any specific time?
Answer: They were taken within a given month whenever needed.

3:15 P.M. Growth of Orchardgrass and Tall Fescue as Affected by Seed-shoot Removal at Six Different Stages of Maturity - P. B. Burrus, Jr., and T. H. Taylor, Lexington, Ky.

Three experiments were conducted in 1956 to study the effect of initially removing the seed-shoot of orchardgrass and tall fescue at different physiological stages of maturity upon the subsequent growth behavior of the grasses. Orchardgrass growth was observed on plants grown in the greenhouse, space-planted in the field and in sod plots. Growth of tall fescue was observed in sod plots only.

Results from the greenhouse and space-planted field experiments show that harvesting orchardgrass plants at different physiological stages of growth affect dry matter yield and root growth. Unexpected flowering of orchardgrass plants wintered under greenhouse conditions and re-transferred to the field in May was observed and the specificity

of environmental conditions necessary for flowering is questioned. Rust infection appeared to be much more severe on mature leaves than on vigorously growing leaves of orchardgrass plants grown as widely spaced plants.

Results from the sod-plot experiments of orchardgrass and tall fescue show clearly that weediness, seasonal grass yields, leaf production, and stem production were related to the cutting management practices.

Discussion:

Question: How were the clipping treatments made after the boot stage?
Answer: Cuttings were made at 30-day intervals subsequent to the initial harvest.
Q.: What was the plant height at 14 days?
A.: Four to eight inches.
Q.: Which treatment resulted in the greatest number of tillers?
A.: We do not know. There was too much variability within treatments to obtain a definite answer.

3:30 P.M. Relationship of Frequency and Severity of Defoliation to Forage Yields - C. S. Hoveland and D. E. McCloud, Gainesville, Fla.

Clipping studies with pearl millet showed that the severity of defoliation, or height of stubble left, exercised considerable effect on forage yields and protein content. Leaving a high stubble of 18 inches actually increased forage yields of plants cut when they were 30 inches tall. Protein yields were influenced to an even greater extent by proper clipping management.

Irrigation has not resulted in increased yields of pearl millet.

Similar type field clipping experiments have been conducted with three oat varieties. Lowest forage yields were obtained from plants clipped continuously at 6 inches with a 2-inch stubble and 18-inch plants clipped back to leave a 9-inch stubble. Twelve-inch plants clipped to leave a 5-inch stubble throughout the winter have yielded as much or more forage than with a 2-inch stubble.

A small-plot sheep grazing experiment was devised to compare oat forage plant behavior under clipping versus grazing. Forage production in the grazed paddocks was determined by clipping quadrats at random and then allowing the sheep to graze the area down to the stubble height within the clipped quadrats. Yields from the grazed paddocks agreed quite closely with yields from the clipping experiments.

Leaving a 5-inch stubble after clipping or grazing by sheep resulted in virtually no winter-killing from freezes whereas closely grazed paddocks or clipped plots (1- to 2-inch stubble) had almost 100% kill. In general, irrigation increased oat forage yields by one-third.

Discussion:

Question: Did the oats go to maturity?
Answer: Yes, in some treatments.
Q.: Was the forage yield of oats recorded as green or dry weights?
A.: On a dry weight basis.
Q.: What yields of oats were obtained from the 18-9, 18-5, and 18-2 treatments?
A.: The yields are not available.

3:45 P.M. The Response of Certain Cool Season Perennial Grasses to Frequency, to Height of Clipping and to Supplemental Irrigation - R. D. Hicks, Auburn, Ala.

During the late summer of 1955, a study was located on the Dairy Research Unit near Auburn, Alabama, to determine management practices needed for the maximum production of forage from tall fescue, orchardgrass, and reed canarygrass.

Seedings were made September 17, 1955, and irrigation and clipping treatments in split-split plot design were started in May 1956.

The clipping treatments are as follows:

Clipped at the 1½" level semi-monthly all year.
Clipped at the 1½" level semi-monthly from September 15 to June 1.
Clipped at the 1½" level every six weeks from September 15 to June 1.
Clipped at the 3" level every six weeks from September 15 to June 1.

There are two levels of moisture, natural rainfall and natural rainfall plus supplemental irrigation.

Changes in stands are determined by the point quadrat method. Quadrat counts are made every three months.

Results the first year after establishment showed the average yield of tall fescue higher than that of reed canarygrass or orchardgrass. Tall fescue proved better able to maintain good yields under the more severe clipping treatment than reed canarygrass or orchardgrass.

Increase in production due to irrigating these grasses was significant only during the mid-summer season and for the year as a whole. Irrigation did not increase production significantly during winter, fall, and spring seasons.

Mowing at the 1½-inch level every six weeks from September 15 to June 1, gave the highest yields of all clipping treatments. Clipping at the 3-inch level every six weeks or clipping at the 1½-inch level every two weeks from September 15 to June 1 gave approximately the same yield. Mowing at the 1½-inch level every two weeks all year resulted in the lowest yields.

Tall fescue was the only grass studied that showed an increase in percent ground cover under both moisture levels and under all clipping treatments. Orchardgrass showed a reduction in the percent ground cover under all clipping treatments.

The percentage increase in ground cover by tall fescue and reed canarygrass was greater and the reduction in the percent ground cover by orchardgrass was less under conditions of supplemental irrigation.

There was a direct correlation between the height of clipping and persistence of these grasses. There was also a negative correlation between mid-summer clipping and persistence. Mowing at a high level every six weeks from September through May resulted in the best stand of each grass. Frequency of clipping during this period has little effect on the persistence of the grasses.

4:00 P.M. Response of Coastal Bermuda, Pensacola Bahia, and Dallisgrass to Irrigation and Nitrogen Levels - W. R. Langford, E. M. Evans and G. H. Rollins, Auburn, Ala.

Three split-plot experiments were started during 1955 to determine the effect of supplemental irrigation, legumes, and nitrogen on the yield of several warm season perennial grasses. Two of these experiments are located at the Tennessee Valley Substation, one on Dewey clay loam and the other on Humphries silt loam. The third experiment is on Cecil sandy loam at the Dairy Research Unit near Auburn.

Irrigated plots in all three experiments received 8-10 inches of water in addition to 19 inches natural rainfall during the 1956 growing season. The average yield of Coastal Bermuda planted alone under all treatments in the three tests during 1956 was 5.5 tons of oven dry forage per acre. The yield of Pensacola Bahiagrass was 4.6 tons, and that of Dallisgrass was 3.6 tons. The effect of irrigation on the yield of these grasses is shown in Figure 1.

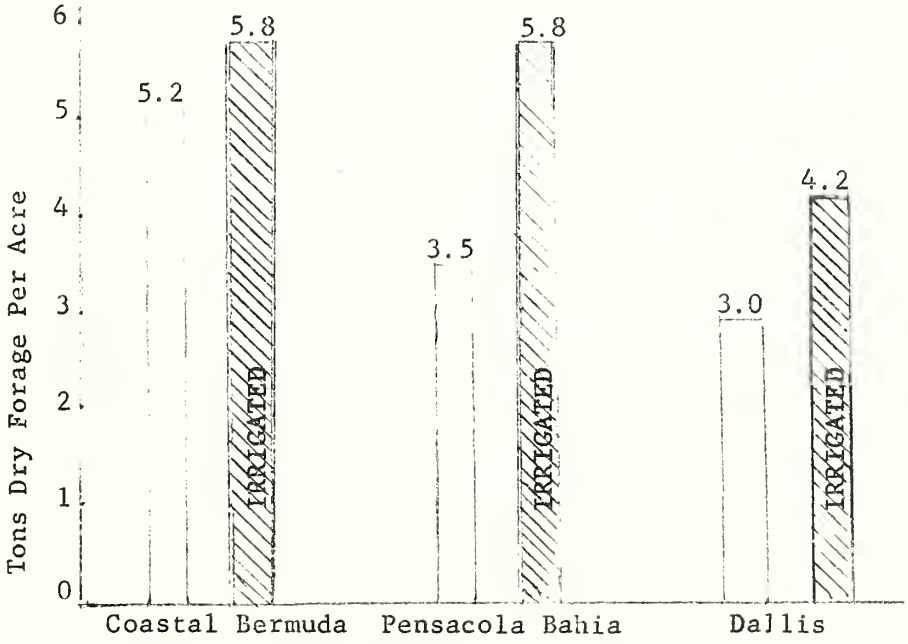

Fig. 1. Effect of irrigation on forage yield of Bermuda, Bahia, and Dallisgrass.

The yields of Bahiagrass and Coastal Bermuda were the same under irrigation. Each averaged 5.8 tons per acre, but droughty conditions retarded the growth of Bahia much more than they affected Coastal Bermuda. With natural rainfall and no irrigation Bahiagrass produced only 3.5 tons per acre. Coastal Bermuda made 5.2 tons per acre under the same conditions. Dallisgrass was the least productive of the three species under both irrigated and non-irrigated conditions. A disease that caused severe yellowing of leaves and decaying of crowns thinned stands and limited production of Dallisgrass. This disease was first observed on irrigated plots where it was most severe, but it also occurred on Dallisgrass that was not irrigated.

The productivity of these grasses alone and of grass-crimson clover mixtures, each under two levels of nitrogen, is shown in Figure 2. These results are from the test at the Dairy Research Unit only because some treatments were omitted from the experiments at the Tennessee Valley Substation. The average yield of Bahiagrass planted alone and not nitrated was 2.6 tons per acre. That of Coastal Bermuda was 1.8

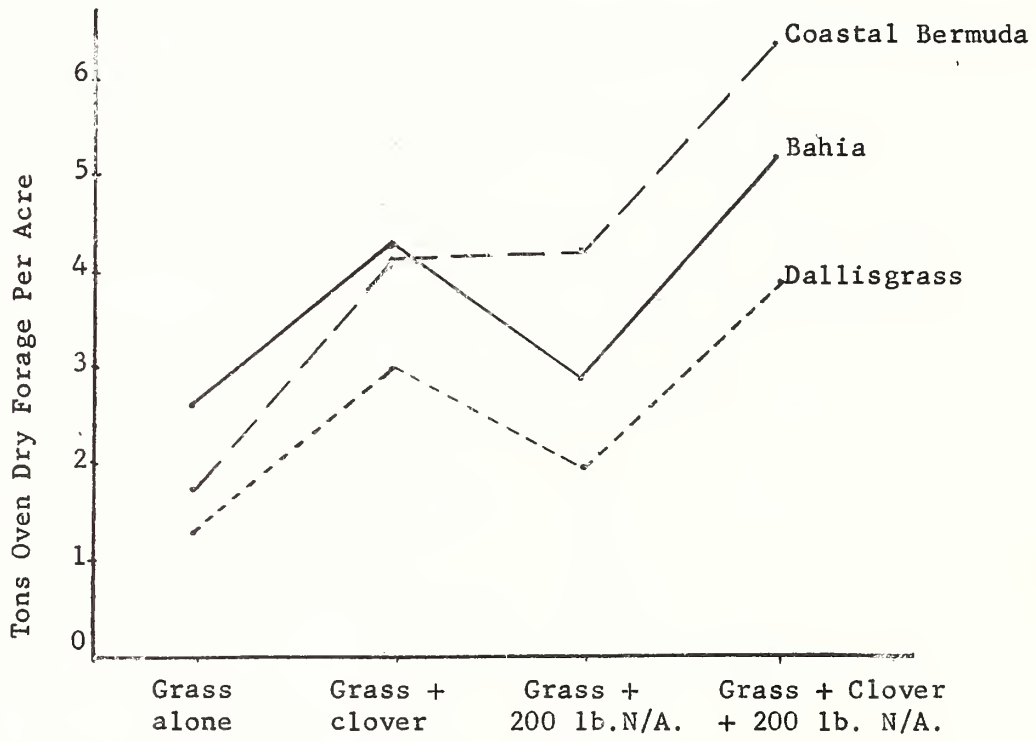

Fig. 2. Yield of grasses alone and of grass-clover mixtures under two levels of nitrogen.

tons, and that of Dallisgrass was 1.3 tons. Two hundred pounds of nitrogen per acre applied in four applications of 50 pounds each at 45-day intervals increased the yield of Bahia from 2.6 tons to only 2.8 tons per acre, but it increased the yield of Coastal Bermuda from 1.8 tons to 4.2 tons per acre. Grass-crimson clover mixtures without any applied nitrogen were more productive than grasses grown alone and not nitrated. Crimson clover increased production more where planted with Coastal Bermuda than where planted with Bahia or Dallisgrass. Dallisgrass and Bahiagrass planted alone and fertilized with 200 pounds of nitrogen per acre were considerably less productive than un-nitrated Dallisgrass-crimson clover and Bahiagrass-crimson clover mixtures. Un-nitrated Coastal Bermuda-crimson clover mixtures made the same amount of forage as Coastal Bermuda planted alone and fertilized with 200 pounds of nitrogen per acre.

Nitrogen applied to grass-legume mixtures increased production about the same amount that it did where applied to grass in pure stands. Bahiagrass-clover showed little response to nitrogen, just as did Bahiagrass planted alone; but nitrogen increased the yield of Coastal Bermuda clover mixtures from 4.2 tons to 6.0 tons per acre. Dallisgrass alone and Dallisgrass-legume mixtures showed a moderate response to nitrogen, but it was the least productive of the three grasses under every nitrogen level studied.

The effect of irrigation on the yield of Coastal Bermuda and Bahiagrass at various levels of nitrogen is shown in Figure 3. Without any

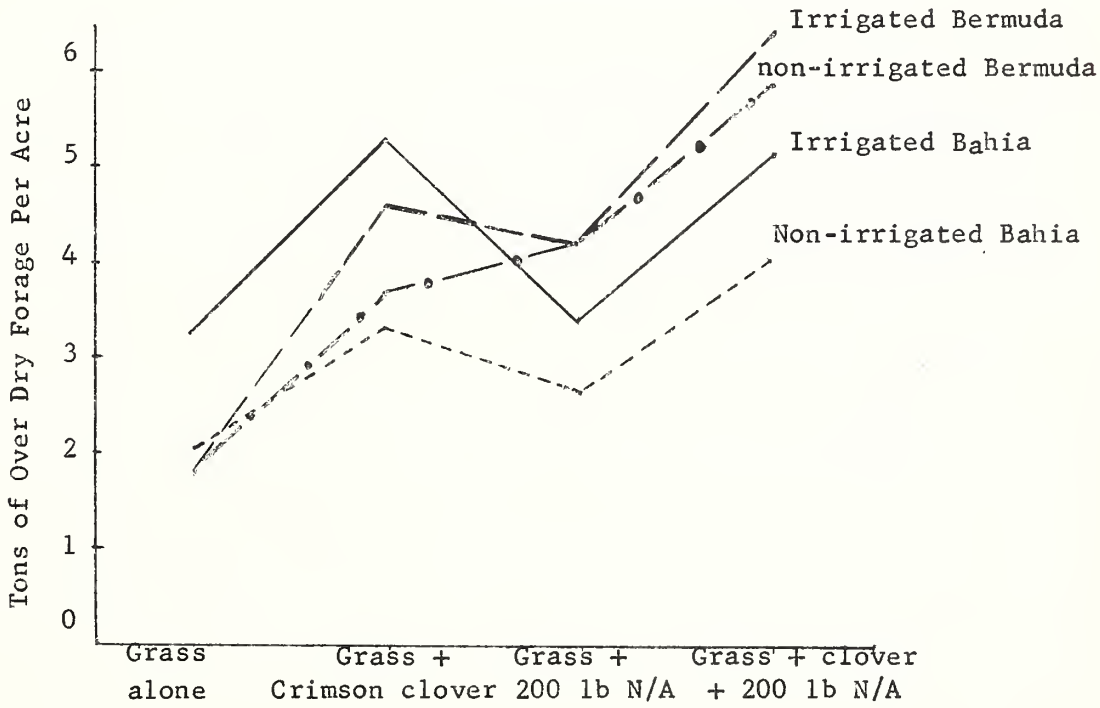

Fig. 3. Yields of two grasses at various levels of nitrogen with and without irrigation.

applied nitrogen the yield of Coastal Bermuda alone was the same on both irrigated and non-irrigated plots, but irrigation increased the yield of Bahiagrass planted alone and not nitrated from 2.0 tons to 3 3 tons per acre. Likewise, where two hundred pounds of nitrogen per acre was applied to grasses in pure stands, irrigation did not affect the yield of Coastal Bermuda; but it increased considerably the yield of Bahiagrass. Grass-clover mixtures showed somewhat higher increases in production due to irrigation than did grasses planted alone because of better clover growth during the fall on irrigated plots.

From these data it is apparent that: (1) Coastal Bermuda is more responsive to nitrogen than is Bahia or Dallisgrass; (2) Bahiagrass is more sensitive to and less productive under droughty conditions than is Coastal Bermuda; and (3) the yield of Coastal Bermuda-crimson clover without applied nitrogen is as high as that of Coastal Bermuda alone and fertilized with 200 pounds of nitrogen per acre.

Discussion:

Question: What cutting practices were used?
Answer: Cuttings were made every 28 days starting at the end of the pasturing treatment.
Q.: Did the nitrogen applications result in lower clover yields?
A.: Not under these conditions.
Q.: How well has Bahiagrass persisted?
A.: We have some stands established in 1951. Most of the difficulty has been in seeding.

4:15 P.M. Harvesting Legume and Grass Seeds in the Southeast - J. K. Park and B. K. Webb, Clemson, S. Car.

Studies involved in harvesting various grass and legume seeds have been conducted for the past five years in South Carolina. The work has been cooperative between the U. S. Department of Agriculture and the South Carolina Agricultural Experiment Station. Tests have been conducted in crimson clover, fescue, lespedezas, and various other seed crops. Harvesting practices and equipment have been studied in the various crops with particular emphasis on determination of source and amount of seed losses.

Harvesting Practices

Time of harvest is the most important single factor affecting the harvested yield from legume and grass seeds. The seed are usually easily shattered by weather when mature and generally some seed have shattered to the ground by the time the crop has matured to its optimum harvestable yield. In practically all cases the maximum yield from direct combining was obtained during the few days when the last seed in the field were reaching maturity. (Maturity in this case refers to a seed which has lost most of its moisture, has a mature appearance, and is easily shattered from the plant).

Windrow and swath harvesting were compared to direct combining in several crops. Although both methods had advantages in particular situations, direct combining was usually preferable. Various methods and equipment for windrow or swath harvesting were studied. The swath was usually much preferred to the windrow because of faster drying. The draper type pickup attachment was most satisfactory for harvesting windrows or swaths.

Chemical defoliation usually increased harvested yield and decreased seed moisture content to some extent in these crops.

Control of the clover head weevil in crimson clover with several insecticides increased harvested yield as much as 100% in some tests.

Seed quality studies showed that quality is affected by various factors including stage of maturity when mowed, mechanical damage from the combine, moisture content of the seed, and trash content. These things in turn will be affected by harvesting methods and harvesting equipment.

Combine Operation and Adjustments

Combine operation and adjustments have a most important influence on the quality and quantity of seed harvested. Combine performance in any given situation depends upon a number of things including adjustment, operator, crop condition, weather and design of the combine. Any one of these factors can have a decided influence on the quality of results possible in the particular situation. Although different adjustments will assume primary importance in different crops, the basic adjustment procedure is similar in all crops.

Combine Components

Combine components may be divided basically into components for cutting, threshing and cleaning. There was found to be considerable difference in the efficiency of various components of differnt combines in the several crops, and also in the overall efficiency of different machines in the different crops. These differences are often of considerable importance in their effect on quantity and quality of seed harvested. Tined reels were superior to bat reels in many crops and conditions.

Harvesting Test Results in Various Crops

Following are some of the results and conclusions from harvesting tests in various crops:

CRIMSON CLOVER

1. Ground speed should be low. Usually about 1-1/2 mph.
2. Cylinder speed should be set at maximum rpm.
3. Cylinder clearance should be about 1/8 inch.
4. The maximum number of concaves provided for in a combine should be used.
5. Rubber on angle bars and concaves significantly reduced seed damage.

6. A solid or closed concave grate is definitely preferable to an open concave grate.
7. Cleaning loss was usually less than 5 percent, but in a few cases was over 25 percent. This loss varied with make of combine, adjustments, and harvesting conditions.

FESCUE AND RESCUE

1. Shattering loss was the most important consideration.
2. Maximum direct combined yield was obtained while seed moisture was too high for storage without drying.
3. Threshing and cleaning losses were relatively small for all combines.

SMALL GRAINS

1. Comparison of angle and rasp bar cylinders and comparison of open and closed grates did not show appreciable differences in threshing performance.

COMBINE PEAS AND SOYBEANS

1. Seed damage is a most important consideration.
2. Threshing and cleaning losses are normally very small if the combine is properly adjusted.
3. Seed damage can be minimized by proper cylinder adjustment and by adjusting the cleaning shoe so there are few seed in the tailings.

KOBE AND KOREAN LESPEDEZA

1. Major seed losses are weather shattering and cutterbar shattering.
2. Threshing loss is generally very small and aggressive cylinder action is unnecessary in mature lespedeza.
3. Cleaning loss is also generally small. However, careful cleaning adjustment will minimize trash content and hulled seed.

SERICEA LESPEDEZA

1. Weather shatter is the most serious loss.
2. Threshing and cleaning losses are low if the crop is mature.
3. Maximum yield by direct combining often occurs just after first killing frost. (Also true in Kobe).

SESAME

1. In indehiscent sesame, seed loss was low when cylinder speed was high but the resulting gain in harvested yield was offset by reduced germination of seed harvested at the higher cylinder speeds.
2. Sometimes there is considerable loss from stalks falling ahead of cutterbar after being severed by sickle.

Question: What cylinder spacing was used for sericea?
Answer: One-eighth inch.

4:30 P.M. The Use of the Electrostatic Separator for Improving the Quality of Forage Crop Seeds - H. D. Bunch, State College, Miss.

The electrical properties of seeds may be used in separating weed seed from crop seed during the cleaning process, provided the conductivity or contact potential differ among the species involved. If successful, this method of seed cleaning could be a valuable tool in the cleaning of forage crop seeds. It would be especially useful in effecting seed separations not possible by present methods, which are based upon the physical properties of seeds.

Electrostatic separators are now being used in the milling and mining industry. Laboratory models used in research at State College in the Seed Technology Laboratory are capable of producing a range of voltages up to 50,000, direct current, plus or minus polarity.

Mixtures of red clover seed and dock were used im portions of the study to determine the effect of various factors which influence the electrostatic separation of seed. The variables on which evaluation was attempted involved moisture content of the seed, relative humidity and temperature of the air, polarity of the electrical charge, position of the electrode, speed of the grounded roll, voltage intensity, and surface moisture of the seed.

The best separation (100%) with the least number of passes (3) through the machine was accomplished under the following conditions: high intensity field; seed moisture, 7.78; relative humidity, 44%; temperature, 78° F.; speed of the grounded roll, 30 RPM; and an electrode position of 30° from the horizontal axis of the roll. Surface drying of the seed increased the effectiveness of the separator on the seed samples in the higher moisture groups. Passage of the seed through the electrical field did not decrease percentage viability of the red clover seed.

Pigweed seed was removed from some lots of White Dutch and Ladino clovers by passage through a low intensity field. One lot of Ladino containing over 14,000 pigweed per pound was cleaned to a count of 50 pigweed per pound. This was accomplished with a loss of less than 3% clover in a mixture for which there is no satisfactory mechanical method of separation. However, this problem is not solved because all lots of clover do not respond the same, even with the same pigweed seed.

Further studies are planned in an attempt to determine the potential value of this type of equipment in improving the quality of forage crop seed for planting.

Question: Have you noticed any effects of the high voltage on seed germination?
Answer: No.

4:40 P.M. Effects of Management on Growth and Development of Soil Improving Legumes - R. D. Staten, College Station, Texas

Experiments were conducted to study the effects of harvest frequency on top and root development of alfalfa, biennial sweetclover and annual sweetclover. In addition, forage and roots were analyzed to determine the optimum system of management prior to the utilization of these crops for green manure.

The root development of biennial sweetclover (Madrid) was superior to that of annual sweetclover (Hubam) even during the seedling year of production. Total seasonal production was not only highest for Madrid but its growth was well distributed throughout the summer season. Hubam produced greater yields of forage than Madrid in the early season and had completed its life cycle by early summer. Therefore the use of Hubam sweetclover should not be discouraged where an annual fits best in a particular production program.

Little or no advantage was gained in the production of forage, roots or total nitrogen by allowing Hubam to go beyond the optimum stage of growth for good hay. Continuous frequent harvest of Madrid was detrimental to the root system in late summer and subsequently the production of forage and roots during the second year was reduced. The most frequent harvest treatment on alfalfa amounted to cutting in the 1/10 to 1/4 bloom stage and resulted in the best production of forage, roots and total nitrogen.

The excellent root development and forage production obtained during the first growing season on biennial sweetclover and alfalfa may result in more extensive use of these crops for soil improvement purposes.

Comments:

Dr. Blaser: I would like to suggest that we stop making clipping treatments and reporting data on a time basis. It is more pertinent to cut at a particular stage of growth and to record plant height, stage of blooming and closeness of cut. There is some evidence of a trend in this direction in the papers being presented at this Conference but I think we should be making more of an effort.

Dr. McCloud: I want to announce a reminder of the Work Planning Conference tomorrow morning at 8:30 A.M.

Dr. Taylor: Anyone interested in seeing our new forage crop dryers may do so at the end of this meeting.

8:00 A.M. Groups 1 and 2. R. W. Engel, Virginia, Chairman
W. B. Anthony, Alabama, Section Secretary

Invitational Paper: R. E. Blaser, Blacksburg, Va.

Dr. Blaser presented an interesting account of his recent tour of Hawaii and Australia. The presentation was beautifully illustrated with colored slides.

Following Dr. Blaser's presentation, Dr. Engel made a few introductory remarks to introduce two papers to follow on the subject of forage evaluation. He pointed out that deficient energy intake constituted the greatest limiting factor in obtaining successful utilization of forage crops through livestock. In some instances protein and in other instances mineral insufficiency may cause trouble. Nevertheless, energy deficiency is most important. Dr. Engel defined digestible and non-digestible energy and pointed out that digestible energy constituted on the average about 60 percent of the gross energy of feed stuffs. It was explained that digestible energy could be further separated into heat production, urinary and gaseous energy and net energy. He pointed out that only digestible energy could be measured conveniently under grazing but that energy losses in urine and gases were reasonably constant at 21%. Dr. Engel called for greater appreciation of a "digestible energy concept" for evaluating forage crops.

8:30 A.M. Indicator Techniques with Cattle, Their Usefulness and Shortcomings - W. A. Hardison, Blacksburg, Va.

An attempt has been made to review the usefulness and shortcomings of fecal nitrogen, fecal chromogen and chromic oxide as indicators for measuring the digestibility and consumption of forages by grazing animals.

Based upon presently existing evidence, it appears that digestibility may be predicted quite accurately by the fecal nitrogen or fecal chromogen method as a result of analyzing randomly procured samples of feces. More needs to be known concerning the factors which may influence the excretion of these indicators by the grazing animal. The fecal index method would appear to offer certain advantages over the indigestible tracer technique for predicting forage digestibility.

At the present time chromic oxide appears to be the indicator of choice for estimating fecal production. Because of the non-uniform excretion of this material, the sampling of feces is not a simple matter. Accurate estimates of fecal output have resulted, however, where grab samples of feces have been obtained twice daily (morning and night) and composited over periods of several days. When more is known about the various factors influencing the excretion of chromic oxide, a more precise fecal-sampling procedure can be devised.

Discussion:

There were no direct questions from the audience. Dr. Engel called attention to the fact that equation for calculating amount of chromogen in forage as developed by Reid, et al. was based on tests conducted with hand-plucked forage. Apparently a good job was done in selecting the forage.

9:00 A.M. Use of Indicator Techniques with Sheep - P. G. Woolfolk, Lexington, Ky.

A number of indicator substances have been used in digestion and forage intake studies with sheep with varying degrees of success. These include lignin, fecal nitrogen and chromogen, all of which originate with the plant. Inert material such as chromic oxide, iron oxide, barium sulfate and various dyes have also been used to determine digestibility when feed intake is known. Some of these latter materials have been studied as indicators of fecal excretion by various workers in attempts to eliminate the use of fecal collection bags.

At the Kentucky Station, a series of trials has shown that the chromogen technique is satisfacatory for use in determining digestibility of forages grazed by lambs and also intake if fecal excretion is known. Although considerable variability in chromogen excretion occurs during the day, there appears to be no pattern of excretion and grab samples taken over a 5-day period at any time of day have been shown to be satisfactory. Work with chromic oxide has not been as fruitful. Variation of excretion is greater than for chromogen and in some cases recovery of chromic oxide has been low. In the last trial run, the average range in excretion of chromic oxide was reduced from 15 percent when administered twice daily by capsule to 7 percent when administered four times daily. However, average recovery was only 80 percent. Thus, these results suggest the need for continued use of collection bags with sheep on pasture trials in which intake is to be calculated by indicator methods.

Discussion:

There were no formal questions from the audience. Dr. Engel pointed out that the trouble encountered in the application of the indicator technique with grazed sheep was with the external indicator. The chromogen method for digestibility appeared to give reliable results.

9:30 A.M. Methods of Controlling or Preventing Pasture Bloat - B. F. Barrentine, State College, Miss.

Paddocks of Ladino clover are used in experimental bloat studies. Steers graze these paddocks for 90 minutes morning and afternoon and between grazing periods the steers are kept in dry-lot with shade and water but no feed. Steers which bloat regularly under this program are selected for experimental studies. Selected steers bloat about 90 percent of the time and thus afford an excellent opportunity to test products for their value in preventing bloat.

Sod-seeded ryegrass in Ladino clover reduces the incidence of bloat. The main disadvantage of this system is that a bloat problem has to be anticipated so that sod-seeding can be done at the proper time. Also, the cattle may graze out the ryegrass and end up with an almost pure stand of clover.

Neither detergents (alkyl aryl sulfonates) nor methyl silicones have shown any practical value in controlling bloat on the Mississippi Experiment Station.

Properly prepared penicillin-salt mixtures, offered free choice to cattle on legume pasture, show excellent results in controlling bloat. A group of steers received a penicillin-salt mixture for 28 days while on the above grazing program and bloat control was good throughout the 28-day period. There are indications that the amount of penicillin required to prevent bloat is increased in steers that have received penicillin for a period of time.

Discussion:

Evans: Have you tested antibiotics other than penicillin?
Answer: Yes, we have tried a number of other antibiotics. Penicillin appears to be most effective. Aureomycin is effective in large doses.
Henson: What kind of microorganisms are held back by antibiotics?
Answer: I do not know. This is being studied.
Beard: What is the cost of penicillin treatment?
Answer: About two cents per steer per day. The price the manufacturer charges for the product varies.
Wilcox: Does the treatment affect growth of animals?
Answer: In some cases growth may be affected. We have not observed any dairy cattle going off feed following treatment.
Question: Does penicillin appear in milk of lactating cows?
Answer: We have not detected penicillin in milk although we have fed 200 mg. per day to dairy cows.
Martin: What is the influence of penicillin on the rate of gain of grazing animals?
Answer: No information is available from our study.
Beard: Have you tried spraying forage with peanut oil to control bloat?
Answer: No we have not tried the oil spray.
Engel: We have observed that high antibiotic feeding causes steers to go off feed. Is this what happens in bloat?
Answer: It could be.
Engel: Do you measure intake of forage in your bloat studies?
Answer: Some information has been obtained. We weighed steers before and after grazing. The animals treated with penicillin showed to have eaten more than the non-treated animals. A report out of New Zealand mentions that animals gorge themselves after penicillin therapy.
Evans: What about phosphorus therapy in the control of bloat (South Carolina report)?
Answer: My opinion is that phosphorus therapy is of no benefit. I have observed instances where forage high in phosphorus increased the incidence of bloat.

10:35 A.M. The Effect of Thickness of Stand on Yield Distribution and Seed Production of Crimson Clover - W. E. Knight, State College, Miss.

Dixie crimson clover was grown in a 7 x 7 Latin square experiment to measure the effects of thickness of stand on physiological and morphological characteristics of crimson clover. Seven spacings were used, ranging from 3/4 to 6 inches. Measurements were taken for height, number of stems, number of heads, number of florets per head, forage yield and seed yield. Continuous records of soil temperature were kept for three of the spacings representing the thickest, intermediate and thinnest stands. Spacings differed significantly for all of the measurements mentioned. Early growth occurred on the 3/4, 1 and 1½-inch spacings. In the absence of utilization, the plots were damaged by Sclerotinia trifoliorum. Clipping the forage during the growing season controlled Sclerotinia. Total forage yield was reduced slightly by clipping, but the forage from the clipped plots was of higher quality. Seed yields were also reduced by clipping. Best seed yields were obtained from the thinnest stands. Early growth appears to be related to high soil temperatures which prevail under the thick stands at night. Although the temperature differential between thick and thin stands in November and December is not too great, it appears to be sufficient to allow growth on thickly spaced plots, whereas plants on the thinly spaced plots are not able to make appreciable growth.

Discussion:

Question: Were yield calculations based on harvest to center of alleys or to edge of plots?
Answer: To edge of plot - not alley way. The edges of the plots were a little depressed but this would be expressed as a negative influence.
Q.: Was there actual depression around the edges.
A.: There was more depression around the edges.
Hanson: Can you make general farm recommendations from this work?
Answer: This represents a synthetic situation - the thicker end of spacings look promising. We plan to select fields with upwards of 1200 pounds of seed on the ground and attempt to establish thick stands with irrigation.
Hanson: Irrigation and grazing would keep down the disease problem.
Donnelly: How can the practice be adapted to space planting tests?
Answer: In the space planted nursery this technique cannot be used.

11:00 A.M. General Business Meeting - W. W. Huffine, Okla., Chairman

The meeting was called to order by Dr. Huffine. In the election of a new member of the Executive Committee, the nominating committee presented the name of Norman L. Taylor of Kentucky. It was moved and seconded that the nominations cease and Dr. Taylor was unanimously elected.

The Executive Committee for the coming year is as follows:

	Term expires
R. E. Blaser, Va.	1958
W. W. Huffine, Okla.	1959
P. B. Gibson, S. Car.- Chairman	1960
E. C. Holt, Texas	1961
N. L. Taylor, Ky.	1962
R. H. Lush, Ky., Dairy Husb.	
H. H. Leveck, Miss., Animal Husb.	
P. R. Henson, Permanent Secretary	

The location of a meeting place for the 1958 conference was next in order of business. The Chairman pointed out that Mississippi in addition to Kentucky, had invited the group to meet there in 1957. The Kentucky invitation had been accepted since the group had met in Mississippi in 1948 and had not met in Kentucky since 1946. The Chairman read an invitation from Dean Farrar of South Carolina, inviting the group to South Carolina in 1958. Since the group had not met at all in South Carolina, the invitation from that state was accepted.

Chairman Huffine called attention to an earlier request that a committee on forage evaluation be established for the southern region. He pointed out that a committee of the Agronomy Society had reported on this same subject in January 1952. Dr. Fergus(Ky.) stated that he felt that the report in the Agronomy Journal did not answer all of our problems in that we cannot make all of our evaluations with animals. It should be possible to develop a formula for evaluating forages based on small quantities of forage which should be acceptable to other workers. The report in the Agronomy Journal is too general.

Blaser(Va.) stated that the 1952 report was a joint report of four societies, Agronomy, Dairy Science, Animal Production and Range Management. The problem is a national one but that their report may not be sufficiently specific to answer the needs of this conference.

Fergus(Ky.) stated that he understood that the northeastern forage workers were proposing a similar committee.

McCullough(Ga.) stated that if the Agronomy and the Animal men would s it down together and if they were willing to throw out extremes, more satisfactory techniques could be used. Techniques which will help the plant breeder are needed.

Fergus expressed the hope that McCullough could get the idea across to other Animal men as to southern needs in this regard.

Blaser stated that a committee of four should be formed from workers in Dairy and Animal Science, a forage breeder and a management man who has an appreciation of the importance of environmental and ecological factors with respect to the forages.

McCullough stressed the importance of getting interested men on such a committee. He moved that the incoming chairman establish a committee of appropriate personnel to set up standards of forage evaluation techniques. The motion was seconded and approved by voice vote.

The Chairman asked for suggestions as to the type of program desired for the 1958 meeting. There were a number of suggestions. In general, the program should encourage more discussions through panel-type programs. It was indicated that there were too many papers on the program of this conference.

Blaser felt that there were not enough papers of interest to the Animal men and that their participation should be encouraged.

McCaleb(Fla.) suggested the need of a section of the program where new forages, species adaptation, etc., might be discussed.

Evans(Ala.) pointed out that the general management systems do not fit all crops.

McCullough stated that more discussion was needed on feed crop systems, seeding and establishment.

The Chairman expressed the opinion that such topics would lend themselves to a discussion-type program and also that the program should supplement the S-12 discussion.

Dr. Lewis(Tex.) called attention to the need to consider other outlets for forages other than through animals. Arrangements are now being made to screen forages for content of other chemicals which may have industrial value.

Dr. Earhart(S. C.) expressed the feelings of the membership when he asked that the members of the Kentucky staff be thanked individually and collectively for their excellent assistance and facilities in making the 14th Conference such a success. A round of applause to the membership from Kentucky followed Dr. Earhart's statement.

The new Chairman for 1958, Dr. P. B. Gibson, from South Carolina, was introduced. The conference was adjourned at 12:00 Noon.

REGISTRATION LIST - 1957

Name	Address	Affiliation
Alabama		
Ansley, William	Auburn	Agron. & Soils Dept., A.P.I.
Anthony, W. B.	"	Anim. Husb. Dept., A.P.I.
Donnelly, E. D.	"	Agron. & Soils Dept., A.P.I.
Evans, E. M.	"	" " " " "
Hicks, R. D.	"	" " " " "
Langford, W. R.	"	" " " " "
Arkansas		
Offutt, M. S.	Fayetteville	Agron. Dept., Univ. of Ark.
Delaware		
Rennie, W. W.	Wilmington	DePont de Nemoirs Company
Florida		
Bullock, R. J.	Ona	Range Cattle Station
Killinger, G. B.	Gainesville	Agron. Dept., Univ. of Fla.
McCaleb, J. E.	Ona	Range Cattle Station
McCloud, D. E.	Gainesville	Agron. Dept., Univ. of Fla.
Ruelke, O. C.	"	" " " "
Wallace, A. T.	"	" " " "
Georgia		
Beaty, E. R.	Athens	Agron. Dept., Univ. of Ga.
Burns, R. E.	Experiment	Botany Dept., Agr. Exp. Station
Burton, G. W.	Tifton	Agron. Dept., " " "
Craigmiles, J. P.	Experiment	" " " " "
Forbes, Ian Jr.,	Tifton	" " " " "
Gantt, C. W.	Athens	Agr. Engr. Dept., Univ. of Ga.
Hughes, Ralph	Tifton	Agric. Expt. Station
James, Edwin	Experiment	Plt. Introd. Dept., Agr. Exp. Station
McCullough, M. E.	"	Anim. Husb. Dept., " " "
Marchant, W. H.	Tifton	Agron. Dept., Agr. Exp. Station
Morcock, J. C.	Atlanta	Allied Chem. & Dye Corp., Nitr. Div.
Newton, J. P.	Experiment	Agron. Dept., Agr. Exp. Station
Sell, O. E.	"	Anim. Indus., " " "
Illinois		
Dutton, H. J.	Peoria	No. Regional Research Lab.
Lohmar, R. L.	"	" " " "
Indiana		
Sotomayor, A. R.	Lafayette	Agron. Dept., Purdue Univ.

Registration List (cont.)

Name	Address	Affiliation
Kentucky		
Buck, C. F.	Lexington	Anim. Husb., Agr. Exp. Station
Buckner, R. C.	"	Agron. Dept., " " "
Burrus, P. B.	"	" " " " "
Diachun, Stephan	"	" " " " "
Doll, E. C.	"	" " " " "
Fergus, E. N.	"	" " " " "
Finkner, V. C.	"	" " " " "
Fortenbery, B. W.	"	" " " " "
Freeman, J. F.	"	" " " " "
Garrigus, W. P.	"	Anim. Husb., " " "
Grainger, R. P.	"	" " " " "
Gray, Elmer	"	Agron. Dept., " " "
Guernsey, A. W.	"	University of Ky.
Guernsey, W. J.	"	" " "
Hatfield, A. L.	"	Agron. Dept., " " "
Henson, Lawrence	"	" " " " "
Jacobson, D. R.	"	Dairy Dept., " " "
Karraker, P. E.	"	Agron. Dept., " " "
Kendall, W. A.	"	" " " " "
Link, Leo A.	Princeton	Agron. Dept., Western Ky. Substation
Loeffel, F. A.	Lexington	Agron. Dept., Agr. Exp. Station
McMakin, W. N.	"	" " " " "
Mahan, Lloyd	"	Farm Supt., " " "
Parsons, A. R.	"	Anim. Husb., " " "
Phillips, S. H.	"	Agron. Dept., " " "
Pierce, Harold	"	" " " " "
Richards, H. R.	Princeton	Western Ky. Substation
Ritchie, Phillip	Lexington	University of Ky.
Seath, D. M.	"	Dairy Dept., Agr. Exp. Station
Shane, J. F.	"	Agron. Dept., " " "
Sigafus, Roy	"	" " " " "
Stroube, W. H.	"	" " " " "
Taylor, Norman	"	" " " " "
Taylor, T. H.	"	" " " " "
Templeton, W. C.	"	" " " " "
Webster, G. T.	"	" " " " "
Welch, F. J.	"	Dean & Dir., " " "
Woolfolk, P. G.	"	Anim. Husb., " " "
Louisiana		
Brown, P. B.	Baton Rouge	Anim. Indus., La. State Univ.
Owen, C. R.	" "	Agron. Dept., Agr. Exp. STation
Maryland		
Beard, D. F.	Beltsville	Field Crops Res. Br., ARS, USDA
Hanson, A. A.	"	Grass & Turf Section, " "
Henson, P. R.	"	Misc. Legume Section, " "
Hollowell, E. A.	"	Clover Section " "

Registration List (cont.)

Name	Address	Affiliation
Mississippi		
Barrentine, B. F.	State College	Anim. Husb., Agr. Exp. Station
Bennett, H. W.	" "	Agron. Dept., " " "
Bunch, H. D.	" "	" " " " "
Knight, W. E.	" "	" " " " "
Missouri		
Wickstrom, G. A.	Columbia	American Potash Institute
North Carolina		
Alexander, C. W.	Raleigh	Dept. Field Crops, Agr. Exp. Station
Blake, C. T.	"	University of N. Car.
Carlson, I. T.	"	Dept. Field Crops, Agr. Exp. Station
Chamblee, D. S.	"	Dept. Agron., " " "
Cope, W. A.	"	" Field Crops, " " "
Gross, H. D.	"	" " " " " "
Hanson, C. H.	"	" " " " " "
Woodhouse, W. W.	"	Dept. of Soils, " " "
Ohio		
Prine, G. M.	Columbus	Agron. Dept., Ohio State Univ.
Oklahoma		
Bates, R. P.	Ardmore	Samuel Roberts Noble Foundation
Chessmore, R. A.	"	" " " "
Elder, W. C.	STillwater	Agron. Dept., Agr. Exp. Station
Harlan, J. R.	"	" " " " "
Huffine, W. W.	"	" " " " "
Puerto Rico		
Brenes-Rivera, Luis	Rio Piedras	Anim. Husb., Univ. of Puerto Rico
Fortuno, J. V.	" "	Plt. Breed. Dept., Univ. of P. R.
South Carolina		
Baxter, L. W.	Clemson	Botany Dept., Agr. Exp. Station
Beinhart, E. G.	"	" " " " "
Earhart, R. W.	"	" " " " "
Gibson, P. B.	"	Agron. " " " "
McClain, E. F.	"	" " " " "
Park, J. K.	"	Agr. Engr. Dept., Agr. Exp. Station
Suman, R. F.	Blackville	Edisto Expt. Station
Webb, Byron K.	Clemson	Agr. Engr. Dept., Agr. Exp. Station

Registration List (cont.)

Name	Address	Affiliation
Tennessee		
Fribourg, H. A.	Knoxville	Agron. Dept., Agr. Exp. Station
Martin, C. M.	Memphis	Quaker Oats Company
Neel, L. R.	Nashville	Farm & Ranch Magazine
Texas		
Bashaw, E. C.	College Station	Field Crops Res., Agr. Exp. Station
Holt, E. C.	" "	Agron. Dept., Agr. Exp. Station
Lewis, R. D.	" "	Director, " " "
Riewe, Marvin	" "	Agron. Dept., " " "
Staten, R. D.	" "	" " " " "
Virginia		
Blaser, R. E.	Blacksburg	Agron. Dept., Agr. Exp. Station
Engel, R. W.	"	Biochem. & Nutr. Dept., V.P.I.
Hardison, W. A.	"	Dairy Sci. Dept., Agr. Exp. Station
Moore, W. E. C.	"	Biol. Dept., " " "
Shoulders, J. F.	"	Agron. Dept., " " "
Smith, T. J.	"	" " " " "
Taylor, L. H.	"	" " " " "
Ward, C. Y.	"	" " " " "
Williams, A. S.	"	Plt. Path. Dept., " " "
Washington, D. C.		
Ronningen, T. S.	USDA	State Expt. Stations Division

APPENDIX - Past conferences and personnel of the Southern Pasture and Forage Crops Improvement Conference.

Place and Date of Past Conferences:

Meeting Place	Date
Tifton, Ga.	July 23, 1940
Raleigh, N. C.	July 19-22, 1941
Lexington, Ky.	May 23-25, 1946
Quincy & Gainesville, Fla.	April 22-25, 1947
State College, Miss.	June 7-9, 1948
Raleigh, N. C.	June 15-16, 1949
College Station, Tex.	May 2-4, 1950
Auburn, Ala.	April 17-19, 1951
Baton Rouge, La.	April 24-25, 1952
Blacksburg, Va.	June 11-13, 1953
Stillwater, Okla.	June 8-11, 1954
Knoxville, Tenn.	June 14-16, 1955
Experiment, Ga.	May 15-17, 1956
Lexington, Ky.	June 11-13, 1957

Personnel of Elected Executive Committees:

Name	Dates
H. R. Albrecht, Ala.	1941-45
H. W. Bennett, Miss.	1946-49
R. E. Blaser, Fla. - Va.	1940-42, 1955-58
G. W. Burton, Ga.	1940-44
D. S. Chamblee, N. Car.	1953-58
L. V. Crowder, Ga.	1954-59
E. N. Fergus, Ky.	1940-41
P. B. Gibson, Ala. - S. Car.	1955-60
P. G. Hogg, Miss.	1956
E. C. Holt, Tex.	1956-61
W. W. Huffine, Okla.	1955-59
G. B. Killinger, Fla.	1950-53
J. K. Leasure, Tenn.	1951-56
R. L. Lovvorn, N. Car.	1940-43, 1946-47
C. R. Owen, La.	1948-52
R. C. Potts, Tex.	1951-55
H. T. Rogers, Ala.	1950-54
P. C. Sandal, Ark.	1952-57
O. E. Sell, Ga.	1947-51
T. J. Smith, Va.	1947-50
N. L. Taylor, Ky.	1957-62
Geo. Warner, Tex.	1946-48
J. B. Washko, Tenn.	1946-50